

MARS GLOBAL ATMOSPHERIC OSCILLATIONS: TRANSIENTS AND DUST STORM
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The existence of transient global oscillations in the atmosphere of Mars was first reported by Tillman in 1981 at the Third International Mars Colloquium, Pasadena Calif Aug. 30 to Sept 2, 1981 and published by Tillman 1984. At these presentations, the transient events were associated with global dust due to their diurnal and semi-diurnal variations, the latter indicating relatively deep dust distributions. One problem with this interpretation is that the events decay in a few sols, an uncharacteristically short time for deep, global scale dust storms. It was also mentioned that their characteristics, taken with those of the surrounding diurnal harmonics, might be related to the presence or absence of global dust storms later in the winter of a given year.

Hamilton and Garcia, 1986, describe the existence of short period normal mode oscillations in the Earth's Atmosphere with periods of from 7 to 50 hours. These include many different modes of interaction, direction of propagation and global symmetry. They also predict the frequency of oscillation for three different types of modes for Mars. Of these, Two Kelvin modes with periods of 23.2 and 11.9 hours may explain many of the characteristics of the transient events. Since the calculated frequencies are very close to that of the diurnal and semi-diurnal, and the events are only a few cycles long and highly non-stationary, it is difficult to distinguish between the Kelvin and solar heated dust oscillations by a casual examination of the pressure traces. However, initial analysis indicates that the periods may not be harmonics of a sol and may be global Kelvin waves. Alternatively, on the basis of frequency alone, gravity and gravity-Possby waves may be responsible for the oscillations.

An important characteristic of the global storms is that in the case of the 1977 A storm, the buildup occurred in about two sols, Tillman, 1984, and the 1977 B storm reached its maximum in about 7 sols. Examination of the pressure data during the buildup indicates that the period of the apparently diurnal and semi-diurnal oscillations may deviate from an exact harmonic during the buildup while remaining close to a harmonic during the many tens of sols of the storm. If confirmed by more detailed analysis, this would mean that the major dust storms are initially triggered by global oscillations which are then followed by solar-heated, dust induced tides. Details of these analyses will be discussed along with speculations about the relation of such global oscillations to the presence or absence of dust storms.

References:

- (1) Tillman, James E., Martian Meteorology and Dust Storms from Viking Observations, Case for Mars II Conference, July 10 -14, Boulder, Colo., 1984 and published in Case for Mars II, V 62, Science and Technology, American Astronautical Society, ed. Christopher P. McKay, 333-342, 1985.
- (2) Hamilton, Kevin and Rolando R. Garcia, Theory and Observations of the Short Period Normal Mode Oscillations of the Atmosphere, submitted, J. Geophys. Res., 1986.